

IDENTITY OF *ENCARSIA* SPP. (HYMENOPTERA: APHELINIDAE)
INTRODUCED INTO WESTERN SAMOA FOR BIOLOGICAL
CONTROL OF *PSEUDAULACASPIS PENTAGONA*
(TARGIONI-TOZZETTI) (HEMIPTERA: DIASPIDIDAE)

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Abstract.—Cultures of *Encarsia* spp. thought to be *E. berlesei* (Howard) from the USA, France and Tonga, were imported into Western Samoa for biological control of *Pseudaulacaspis pentagona* (Targioni-Tozzetti), a pest on passion fruit vines (*Passiflora edulis* var. *flavicarpa* Degener). Comparison of specimens from the cultures with the syntypes of *E. berlesei* and *E. diaspidicola* (Silvestri) revealed both species were present. Both species were released but only *E. diaspidicola* proved to be an effective biological control agent.

Key Words: *Encarsia*, *diaspidicola*, *berlesei*, *Pseudaulacaspis*, *Passiflora*, biological control, Western Samoa

White peach scale, *Pseudaulacaspis pentagona* (Targioni-Tozzetti) is a serious pest on several unrelated plants in many countries (Clausen et al. 1978). In Western Samoa *P. pentagona* is a recently-introduced pest of passionfruit (*Passiflora edulis* var. *flavicarpa* (Degener), where it has contributed to a reduction of 43% in the value of pulp produced between 1984 and 1986 (Peters et al. 1985, Rasch 1986).

The aphelinid parasitoid *Encarsia berlesei* (Howard) has been recorded as an effective biological control agent for *P. pentagona* in several countries (Clausen et al. 1978). Unlike *E. berlesei*, the closely-related *E. diaspidicola* (Silvestri) has not been recognized as an effective biological control agent (Greathead 1971, Waterhouse and Norris 1987). Moreover, *E. diaspidicola* has been considered a synonym of *E. berlesei* by Flanders (1960) and Greathead (1976) despite characteristics noted by Silvestri

(1930) that enabled its separation from *E. berlesei*.

In 1986, three cultures of *Encarsia* spp., all presumed to be *E. berlesei*, were imported into Western Samoa from the USA, France and Tonga for biological control of *P. pentagona*. One species, subsequently identified as *E. diaspidicola*, became an effective biological control agent for this scale insect (Liebregts et al. 1989). Observed differences between specimens from the USA and those from the other two localities, and difficulties with their identification, prompted a comparison of specimens from all cultures imported in Western Samoa with type specimens of *E. berlesei* and *E. diaspidicola*.

MATERIALS AND METHODS

The following were examined:

E. berlesei: Six syntypes on slide bearing two labels (white)—“9942, *Prospaltella ber-*

Table 1. Comparative forewing measurements of *Encarsia* spp.

	No. of Specimens Examined	Measurement ^a		Measurement ^b	
		\bar{x}	Range	\bar{x}	Range
<i>E. berlesei</i>					
Washington, D.C., USA (syntypes)	5	0.12	0.11–0.12	0.37	0.35–0.37
Gainesville, Florida, USA	6	0.10	0.09–0.12	0.37	0.36–0.37
Upolu, W. Samoa (field recoveries)	3	0.12	0.11–0.12	0.36	0.36–0.37
<i>E. diaspidicola</i>					
Capetown, South Africa (syntypes)	4	0.21	0.20–0.22	0.31	0.30–0.31
France (CIBC culture)	7	0.21	0.20–0.22	0.32	0.30–0.32
Tongatapu, Tonga	5	0.21	0.20–0.22	0.32	0.31–0.32
Upolu, W. Samoa (field recoveries)	7	0.22	0.21–0.23	0.32	0.31–0.32

^a Maximum fringe length/wing length.

^b Maximum wing width/wing length.

lese How. on lilac, Washington, D.C., E. R. Sassocei, 2 June 1906"; (red) "Type No. 9942 U.S.N.M." in U.S. National Museum, Washington, D.C., USA.

E. diaspidicola: Nine syntypes on slide bearing two labels (white)—"*Prospaltella diaspidicola* Silv. (Cotypes) *Encarsia diaspidicola* (Silv.) Capetown, S. Afr."; (red) "Cotype No. 41387 U.S.N.M." in U.S. National Museum, Washington, D.C., USA and four specimens on slide bearing one label "*Prospaltella diaspidicola* 10, 1^a generaz. italia Portici—vii. 1909" in the University of Naples, Italy.

Specimens of *Encarsia* spp., cultures from Gainesville, Florida, USA (R. I. Sailer), France (CIBC), Tonga (field collected) and Western Samoa (field collected after establishment) were slide mounted for comparison with the syntypes of *E. berlesei* and *E. diaspidicola*. All cultures were uniparental.

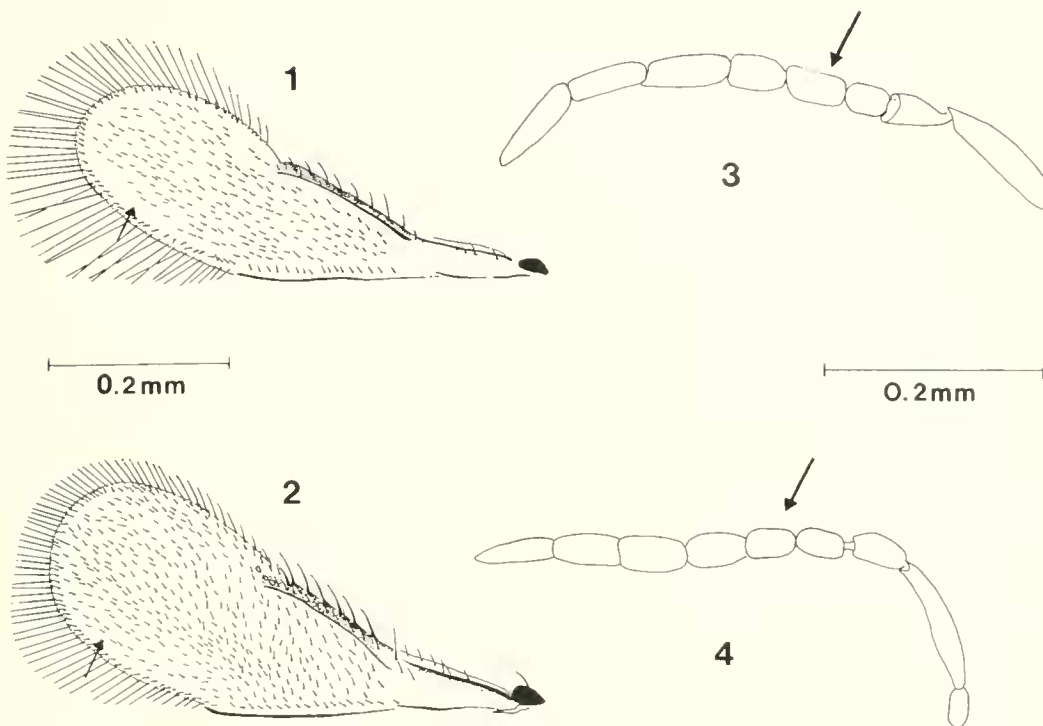
RESULTS AND DISCUSSION

We have compared the syntypes of *E. berlesei* and *E. diaspidicola* with specimens from the three cultures introduced into Western Samoa (Table 1). Despite slight differences observed (in forewing fringe length) between material from Gainesville, Florida, USA and the syntypes of *E. berlesei* from Washington, D.C., USA, we conclude that the two are conspecific. We also conclude

that materials obtained from France and from Tonga are conspecific with the syntypes of *E. diaspidicola* from South Africa.

We have had no difficulty in distinguishing the two *Encarsia* spp., based on Silvestri's (1909) original description of *E. diaspidicola*, his (1930) subsequent comparison of the two species and the differences noted by Gahan (1925). In addition to forewing measurements (Table 1), we have found the following characteristics most useful for distinguishing the two species: the outer forewing margin of *E. diaspidicola* (Fig. 1) is more narrowly rounded than *E. berlesei* (Fig. 2) and there is an area almost free of setae close to the outer margin in *E. diaspidicola*, whereas on the forewing of *E. berlesei* the discal setae extend uninterrupted to the marginal fringe. Funicle segment 2 of the antenna of *E. diaspidicola* (Fig. 3) is clearly longer than segment 1 whereas in *E. berlesei* (Fig. 4) segments 1 and 2 are subequal.

We consider that the identification of these two parasitoids of *P. pentagona* may have been confused in biological control programs. Flanders (1960) considered *E. diaspidicola* to be a synonym of *E. berlesei* without explanation and Greathead (1971) stated that the former was unable to control *P. pentagona* in Europe. In view of the success of Tongan and French *E. diaspidicola* in controlling *P. pentagona* in Western Samoa,



Figs. 1-4. *Encarsia* spp. 1, 2, Forewings of syntypes: *E. diaspidicola* (Silvestri) and *E. berleseii* (Howard), respectively. 3, Antenna of *E. diaspidicola* (Tonga). 4, Antenna of *E. berleseii* (Florida, USA). Arrows indicate areas clear of setae (1, 2) and second funicle segment (3, 4).

some examples attributed to *E. berleseii* may actually refer to *E. diaspidicola*. A taxonomic re-assessment of the *Encarsia* spp. from biological control programs is clearly warranted.

In Western Samoa, *E. diaspidicola* has maintained biological control of *P. pentagona* since its establishment in 1986 (Liebregts et al. 1989). Apart from early field recoveries over a five month period following its release, we have no further evidence for establishment of *E. berleseii*.

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NOTE

Baetis jesmondensis McDunnough, a New Junior Synonym of *Baetis tricaudatus* Dodds (Ephemeroptera: Baetidae)

In their revision of the Nearctic *Baetis* species, Morihara and McCafferty (1979, Trans. Am. Entomol. Soc. 105: 139-221) inadvertently omitted *Baetis jesmondensis* McDunnough from their account of species synonymies. They had found the species equivalent to *Baetis tricaudatus* based on an examination of the type material and larvae tentatively assigned to *B. jesmondensis*. Our recent rediscovery and review of this material leads to the same conclusion, fully substantiating the previous conclusion of Morihara and McCafferty.

Members of the Holarctic *Baetis rhodani* species group, to which *B. tricaudatus* and *B. jesmondensis* belong, demonstrate considerable morphological variation with respect to developmental temperature gradients and geographic distribution. The adult types of *B. jesmondensis* are clearly within the known range of variation of *B. tricaudatus*.

Furthermore, our examination of numerous larval series from the northwestern United States and southwestern Canada, including those assumed to be *B. jesmondensis* and taken from its type locality, showed that all larvae fell within the concept of *B. tricaudatus*. All of these data lead us to reaffirm that the two names are synonymous. We therefore designate *B. jesmondensis* McDunnough as a junior synonym of *Baetis tricaudatus* Dodds, New Synonym.

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